

GAS STORAGE FIELD REVIEW

Name of Operator:		
H.Q. Address:	Field Name and Address:	
Co. Official: Phone No.: Fax No.: Emergency Phone No.: Operator ID#:	Phone No.: Fax No.: Emergency Phone No.: Unit Record ID#: Inspection Record ID#:	
Persons Interviewed	Titles	Phone No.
OPS Representative(s):		
Storage Field Maps (copies for Region Files):		Date(s):
Description of Storage Field:		
<p>Field was converted to gas storage:</p> <p>Type of reservoir being used for storage:</p> <p>Average well depth:</p> <p>Source of the injected gas:</p>		

GAS STORAGE FIELD REVIEW

PIPE, VALVES, and FITTINGS

PIPE					
■ Pipe Grade:					
■ Outside Diameter, in.:					
■ Wall Thickness, in.:					
■ Pipe Wt. - lbs/ft:					
■ Specified Min. Yield Strength, psi:					
■ Footage or Miles:					
■ Pre-1970 ERW Pipe:					

VALVES					
■ Valve Size, in.					
■ Valve Type:					
■ Working Pressure, psi:					
■ Valve Actuation:					

FITTINGS					
■ Fitting Size, in.					
■ Fitting Type:					
■ Working Pressure, psi:					

WELL STIMULATION

ACIDIZING	
Acidizing treatments used to stimulate the wells?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Type(s) of acids used in treating the wells:	
Type(s) of inhibitors used with the acid(s):	
Frequency of the treatments:	Volume of acid per treatment:
Well cleanup procedure following treatment:	
If treatment is flowed back into the well/injection line, criteria used to determine that the treatment will not cause internal corrosion or erosion of the pipe.	

FRACTURING	
Fracturing treatments used to stimulate the wells?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Type(s) of fracturing fluids used in treating the wells:	
Type(s) of inhibitors used with the fracturing fluids(s):	
Frequency of the treatments:	Amount of sand per treatment:
Well cleanup procedure following treatment:	
If treatment is flowed back into the well/injection line, criteria used to determine that the treatment will not cause internal corrosion or erosion of the pipe.	

GAS STORAGE FIELD REVIEW

GAS and LIQUID HANDLING FACILITIES

GAS COMPRESSION

Location of compressors:

Number of compressors:

Total available horsepower:

GAS DEHYDRATION

Location of dehydration units:

Type(s) of dehydration process used:

Number of dehydration units:

Dehydration capacity:

GAS SWEETENING (Acid Gas Treating)

Location of sweetening units:

Type(s) of sweetening process used:

Number of sweetening units:

Sweetening capacity:

GAS/LIQUID SEPARATION

SCRUBBERS/SEPARATORS:

Location of scrubbers/separators:

Type(s) of scrubbers/separators used:

Number of scrubbers/separators:

Separation capacity:

DRIPS:

Location of drips:

Type(s) of drips used:

Number of drips:

Frequency of draining or blowing drips:

FIELD OPERATING PARAMETERS

PRESSURES, RATES and TEMPERATURES

	Pressure, psi		Flow Rate, MMcf/day		Temperature, °F	
	Injection	Withdrawal	Injection	Withdrawal	Injection	Withdrawal
Maximum						
Minimum						

Maximum Allowable Operating Pressure (field):

WATER, CO₂, H₂S, and O₂ CONTENT

	Water, lbs./MMcf	CO ₂ , %	H ₂ S, ppm	O ₂ , %
Injection Cycle				
Withdrawal Cycle				

GAS STORAGE FIELD REVIEW

FIELD OPERATING HISTORY

LEAKS

Are leak surveys of the field being conducted? (49 CFR 192.706) ☐ Yes ☐ No

Have any leaks been found over the past 5 years? ☐ Yes ☐ No Number of leaks:

Type(s) of leaks that have occurred:

Cause(s) of the leaks:

Locations of the leaks:

Has a trend analysis been performed? ☐ Yes ☐ No

If a trend analysis has been done, what do the results indicate?

FAILURES

Have any failures occurred over the past 5 years? ☐ Yes ☐ No Number of failures:

Type(s) of failures that have occurred:

Cause(s) of the failures:

Locations of the failures:

Has a trend analysis been performed? ☐ Yes ☐ No

If a trend analysis has been done, what do the results indicate?

LINE REPLACEMENTS

Have any lines been replaced over the past 5 years? ☐ Yes ☐ No Number of replacements:

Type(s) of replacements:

Locations of the replacements:

Reason(s) for replacements:

LINE REPAIRS

Have any lines been repaired over the past 5 years? ☐ Yes ☐ No Number of repairs:

Type(s) of repairs:

Locations of the repairs:

Reason(s) for repairs:

VALVE REPLACEMENTS

Have any valves been replaced over the past 5 years? ☐ Yes ☐ No Number of replacements:

Type(s) of valve replacements:

Locations of the replacements:

Reason(s) for replacements:

GAS STORAGE FIELD REVIEW

FIELD OPERATING HISTORY (cont.)

GAS and LIQUID HANDLING FACILITY UPSETS

	Gas Dehydration Units	Gas Sweetening Units	Separators
Number of upsets - past 3 years			
Cause(s) of the upsets:			
Has a trend analysis been performed? <input type="checkbox"/> Yes <input type="checkbox"/> No			
If a trend analysis has been done, what do the results indicate?			

CORROSION CONTROL and MONITORING

EXTERNAL CORROSION

Are the field piping and related storage field facilities cathodically protected? (49 CFR 192 Subpart I)		<input type="checkbox"/> Yes	<input type="checkbox"/> No
Type(s) of cathodic protection used:	<input type="checkbox"/> Impressed Current	<input type="checkbox"/> Galvanic Anodes	<input type="checkbox"/> Combination
Criteria used to determine adequate cathodic protection:			
Does the field piping system contain any bare or ineffectively coated pipe?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
Location(s) of the bare or ineffectively coated pipe:			
Amount of bare or ineffectively coated pipe:			
Are corrosion monitoring procedures established for the field piping and related storage field facilities?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
MONITORING:			
Pipe-to-soil readings	<input type="checkbox"/> Yes <input type="checkbox"/> No	Exposed pipe reports	<input type="checkbox"/> Yes <input type="checkbox"/> No
Close interval surveys	<input type="checkbox"/> Yes <input type="checkbox"/> No	Leak surveys	<input type="checkbox"/> Yes <input type="checkbox"/> No
Line current surveys	<input type="checkbox"/> Yes <input type="checkbox"/> No	Instrumented inspection surveys	<input type="checkbox"/> Yes <input type="checkbox"/> No
Remedial measures taken to mitigate corrosion:			

INTERNAL CORROSION

Are corrosion monitoring procedures established for the field piping and related storage field facilities?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
MONITORING:			
Corrosion coupons	<input type="checkbox"/> Yes <input type="checkbox"/> No	Pipe replacement reports surveys	<input type="checkbox"/> Yes <input type="checkbox"/> No
Gas samples	<input type="checkbox"/> Yes <input type="checkbox"/> No	Leak surveys	<input type="checkbox"/> Yes <input type="checkbox"/> No
Liquid (water) samples	<input type="checkbox"/> Yes <input type="checkbox"/> No	Instrumented inspection surveys	<input type="checkbox"/> Yes <input type="checkbox"/> No

CORROSION COUPONS

Frequency coupons are analyzed:
Locations where coupons are installed:

GAS SAMPLES

Frequency of sampling:
Locations where the samples taken:

GAS STORAGE FIELD REVIEW

CORROSION CONTROL and MONITORING (cont.)

INTERNAL CORROSION (cont.)

GAS SAMPLES (cont.)

Are the gas samples analyzed for: <table style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 60%;">Carbon Dioxide (CO₂)</td> <td style="width: 10%;"><input type="checkbox"/></td> <td style="width: 20%;">Yes</td> <td style="width: 10%;"><input type="checkbox"/></td> <td style="width: 10%;">No</td> </tr> <tr> <td>Hydrogen Sulfide (H₂S)</td> <td><input type="checkbox"/></td> <td>Yes</td> <td><input type="checkbox"/></td> <td>No</td> </tr> <tr> <td>Oxygen (O₂)</td> <td><input type="checkbox"/></td> <td>Yes</td> <td><input type="checkbox"/></td> <td>No</td> </tr> <tr> <td>Water vapor</td> <td><input type="checkbox"/></td> <td>Yes</td> <td><input type="checkbox"/></td> <td>No</td> </tr> </table>	Carbon Dioxide (CO ₂)	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	Hydrogen Sulfide (H ₂ S)	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	Oxygen (O ₂)	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	Water vapor	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	Amount of the following present in the gas: <table style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 60%;">Carbon Dioxide (CO₂)</td> <td style="width: 40%;">_____</td> </tr> <tr> <td>Hydrogen Sulfide (H₂S)</td> <td>_____</td> </tr> <tr> <td>Oxygen (O₂)</td> <td>_____</td> </tr> <tr> <td>Water vapor</td> <td>_____</td> </tr> </table>	Carbon Dioxide (CO ₂)	_____	Hydrogen Sulfide (H ₂ S)	_____	Oxygen (O ₂)	_____	Water vapor	_____
Carbon Dioxide (CO ₂)	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No																									
Hydrogen Sulfide (H ₂ S)	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No																									
Oxygen (O ₂)	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No																									
Water vapor	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No																									
Carbon Dioxide (CO ₂)	_____																												
Hydrogen Sulfide (H ₂ S)	_____																												
Oxygen (O ₂)	_____																												
Water vapor	_____																												

What Carbon Dioxide (CO₂) partial pressure criteria are used to establish Carbon Dioxide (CO₂) corrosivity ranges?

What is the Carbon Dioxide (CO₂) partial pressure?

WATER SAMPLES

Frequency of sampling:

Locations where the samples taken:

What constituents are the water samples analyzed for: **(Refer to Water Analysis Checklist)**

Concentration of the following present in the water: <table style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 60%;">Iron (Fe⁺⁺)</td> <td style="width: 40%;">_____</td> </tr> <tr> <td>Manganese (Mn⁺⁺)</td> <td>_____</td> </tr> <tr> <td>Chlorides (Cl⁻)</td> <td>_____</td> </tr> <tr> <td>Sulfates (SO₄⁻)</td> <td>_____</td> </tr> </table>	Iron (Fe ⁺⁺)	_____	Manganese (Mn ⁺⁺)	_____	Chlorides (Cl ⁻)	_____	Sulfates (SO ₄ ⁻)	_____	Amount of the following gases dissolved in the water: <table style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 60%;">Carbon Dioxide (CO₂)</td> <td style="width: 40%;">_____</td> </tr> <tr> <td>Hydrogen Sulfide (H₂S)</td> <td>_____</td> </tr> <tr> <td>Oxygen (O₂)</td> <td>_____</td> </tr> </table>	Carbon Dioxide (CO ₂)	_____	Hydrogen Sulfide (H ₂ S)	_____	Oxygen (O ₂)	_____
Iron (Fe ⁺⁺)	_____														
Manganese (Mn ⁺⁺)	_____														
Chlorides (Cl ⁻)	_____														
Sulfates (SO ₄ ⁻)	_____														
Carbon Dioxide (CO ₂)	_____														
Hydrogen Sulfide (H ₂ S)	_____														
Oxygen (O ₂)	_____														

Is the pH of the water below 6.8? ☐ Yes ☐ No

INSTRUMENTED INSPECTION SURVEYS

Frequency surveys are conducted:

Lines that have been surveyed and when the survey was conducted:

INHIBITOR PROGRAM:

Has a corrosion inhibitor program been established for the field piping and related storage field facilities? ☐ Yes ☐ No

When did the program start?

Type(s) of treatment method used: ☐ Batch ☐ Continuous

Type(s) of inhibitors used:

EROSION (INTERNAL)

Have erosional flow rates been determined for the field piping system? ☐ Yes ☐ No

Are injection/withdrawal flow rates kept below the erosional flow rates to reduce erosional effects? ☐ Yes ☐ No

Has erosion been observed during replacement of components (lines, valves, fittings, etc.)? ☐ Yes ☐ No

Locations where erosion has being found:

Remedial measures taken to mitigate erosion:

GAS STORAGE FIELD REVIEW

CORROSION CONTROL and MONITORING (cont.)

ATMOSPHERIC CORROSION

Are corrosion monitoring procedures established for the field piping and related storage field facilities? ☐ Yes ☐ No

Locations where corrosion has being found:

Remedial measures taken to mitigate corrosion:

SAFETY DEVICES and SYSTEMS

SURFACE FACILITIES

Has a System Safety Analysis of the field piping and related storage field facilities been performed? ☐ Yes ☐ No

Has a Safety Analysis Function Evaluation chart for the field piping and related storage field facilities been prepared? ☐ Yes ☐ No

PRESSURE SAFETY DEVICES:

COMPRESSORS

Is each compressor, per 49 CFR 192.169, equipped with pressure safety devices for overpressure protection? ☐ Yes ☐ No

Pressure protection provided by:

Primary _____

Secondary _____

Location of pressure safety devices:

Primary _____

Secondary _____

PRESSURE VESSELS

Is the working pressure of each pressure vessel (dehydrator, scrubber, etc.) greater than the MAOP? ☐ Yes ☐ No

Is each pressure vessel equipped with pressure safety devices for overpressure protection? ☐ Yes ☐ No

Pressure protection provided by:

Primary _____

Secondary _____

Location of pressure safety devices:

Primary _____

Secondary _____

HEADERS, LATERALS and WELL LINES

Are the headers, laterals and well lines equipped with pressure safety devices for overpressure protection? ☐ Yes ☐ No

Pressure protection provided by:

Primary _____

Secondary _____

Location of pressure safety devices:

Primary _____

Secondary _____

GAS DETECTION SAFETY DEVICES:

Is each compressor, per 49 CFR 192.736, building equipped with gas detection safety devices? ☐ Yes ☐ No

Are other buildings that contain gas handling equipment equipped with gas detection safety devices? ☐ Yes ☐ No

Type(s) of gas detection safety devices:

☐ Combustible gas (L.E.L.)

☐ Hydrogen Sulfide (H₂S)

☐ Other:

Type(s) of alarms used to notify personnel to the presence of gas:

☐ Visual

☐ Audible

☐ Combination

FIRE DETECTION SAFETY DEVICES:

Is each compressor building equipped with fire detection safety devices? ☐ Yes ☐ No

Are other buildings that contain gas handling equipment equipped with fire detection safety devices? ☐ Yes ☐ No

Type(s) of fire detection safety devices:

☐ Flame

☐ Heat

☐ Smoke

☐ Fusible material

☐ Other:

GAS STORAGE FIELD REVIEW

SAFETY DEVICES and SYSTEMS (cont.)

Type(s) of alarms used to notify personnel to the presence of fire:

☐ Visual ☐ Audible ☐ Combination

EMERGENCY SHUTDOWN SYSTEM:

Is each compressor station, per 49 CFR 192.167, equipped with a remote controlled emergency shutdown system? ☐ Yes ☐ No

Does the gas detection system activate the compressor station emergency shutdown system? ☐ Yes ☐ No

Does the fire detection system activate the compressor station emergency shutdown system? ☐ Yes ☐ No

WELLS

Is each well equipped with a well storage safety valves? ☐ Yes ☐ No

If not, are there plans to equip each well with a well storage safety valve? ☐ Yes ☐ No

Reasons why wells should not be equipped
with well storage safety valves?

ADDITIONAL COMMENTS

GAS STORAGE FIELD REVIEW

WATER ANALYSIS CHECKLIST

WATER CONSTITUENTS

Constituent		Yes	No	Constituent		Yes	No
Sodium	Na ⁺	<input type="checkbox"/>	<input type="checkbox"/>	Chloride	Cl ⁻	<input type="checkbox"/>	<input type="checkbox"/>
Potassium	K ⁺	<input type="checkbox"/>	<input type="checkbox"/>	Sulfate	SO ₄ ⁼	<input type="checkbox"/>	<input type="checkbox"/>
Calcium	Ca ⁺⁺	<input type="checkbox"/>	<input type="checkbox"/>	Carbonate	CO ₃ ⁼	<input type="checkbox"/>	<input type="checkbox"/>
Magnesium	Mg ⁺⁺	<input type="checkbox"/>	<input type="checkbox"/>	Bicarbonate	HCO ₃ ⁻	<input type="checkbox"/>	<input type="checkbox"/>
Iron	Fe ⁺⁺	<input type="checkbox"/>	<input type="checkbox"/>	Hydroxide	OH ⁻	<input type="checkbox"/>	<input type="checkbox"/>
Barium	Ba ⁺⁺	<input type="checkbox"/>	<input type="checkbox"/>	Oxygen	O ₂	<input type="checkbox"/>	<input type="checkbox"/>
Strontium	Sr ⁺⁺	<input type="checkbox"/>	<input type="checkbox"/>	Carbon Dioxide	CO ₂	<input type="checkbox"/>	<input type="checkbox"/>
Manganese	Mn ⁺⁺	<input type="checkbox"/>	<input type="checkbox"/>	Hydrogen Sulfide	H ₂ S	<input type="checkbox"/>	<input type="checkbox"/>

WATER PROPERTIES

Property	Yes	No	Property	Yes	No
Acidity	<input type="checkbox"/>	<input type="checkbox"/>	Alkalinity	<input type="checkbox"/>	<input type="checkbox"/>
pH	<input type="checkbox"/>	<input type="checkbox"/>	Salinity	<input type="checkbox"/>	<input type="checkbox"/>
Total Dissolved Solids (TDS)	<input type="checkbox"/>	<input type="checkbox"/>	Specific Gravity	<input type="checkbox"/>	<input type="checkbox"/>

BACTERIA

Bacteria	Yes	No	Bacteria	Yes	No
Sulfate-Reducing Bacteria (SRB)	<input type="checkbox"/>	<input type="checkbox"/>	Acid-Producing Bacteria (APB)	<input type="checkbox"/>	<input type="checkbox"/>